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Indian Standard

SPECIFICATION FOR IRON POWDER (REDUCTION GRADE)

(*First Revision*)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

SPECIFICATION FOR IRON POWDER (REDUCTION GRADE)

(First Revision)

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Indian Standard

SPECIFICATION FOR IRON POWDER (REDUCTION GRADE)

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 10 May 1976, after the draft finalized by the Inorganic Chemicals (Miscellaneous) Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard was originally issued in 1960. The Committee responsible for its preparation decided to revise it in the light of experience gained through the use of this standard since its publication. It was felt that samples of iron powder having the same general specifications as regards its purity, sieve size, etc, might show considerable difference in activity. In the revised standard, therefore, a method of determining the activity of iron powder has been incorporated. The maximum limit of impurity of carbon has also been lowered from 2·5 to 2·0 percent since it had been observed that higher carbon content causes difficulties in filtration during isolation of the product.

0.3 Iron powder is used as a reducing agent in many organic reactions. The material is also known as cast iron grey powder. At present, the requirements within the country are met partly by imports and partly by indigenous manufacture. This standard is intended to serve as a guide to the indigenous manufacturers of the material. It is also expected to assist consumers in making purchases of the material of the requisite quality without imposing undue hardships on manufacturers.

0.4 This standard contains clauses **2.2** and **3.1** which call for agreement between the purchaser and the supplier.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS:2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for iron powder (reduction grade) also known as cast iron grey powder.

2. REQUIREMENTS

2.1 Description — The material shall consist of fine, heavy, free-flowing, greyish, metallic iron powder free from visible impurities.

2.2 Sieving Requirements — The material shall satisfy the sieving requirements as agreed to between the purchaser and the supplier.

2.3 Carbon — The material, when tested by the method prescribed in IS : 228 (Part I)-1972* or IS : 228 (Part IV)-1974†, shall contain carbon not more than 2·0 percent by mass.

2.4 The material shall also comply with the requirements laid down in Table 1 when tested according to the methods prescribed in Appendix A. Reference to relevant clauses of Appendix A is given in col 4 of the table.

TABLE 1 REQUIREMENTS FOR IRON POWDER (REDUCTION GRADE)

Sl No. (1)	Characteristic (2)	Requirement (3)	Method of Test (Ref to Cl No. in Appendix A) (4)
i)	Volatile matter, percent by mass, *Max*	0·25	A-2
ii)	Elemental iron (Fe), percent by mass, *Min*	93·0	A-3
iii)	Manganese (Mn), percent by mass, *Max*	0·5	A-4
iv)	Sulphur (S), percent by mass, *Max*	0·15	A-5
v)	Phosphorus (P), percent by mass, *Max*	1·0	A-6
vi)	Silicon (Si), percent by mass, *Max*	2·5	A-7

---

*Methods for chemical analysis of steels: Part I Determination of carbon by volumetric method (for carbon $\ngtr$ 0·1 percent) (*second revision*).

†Methods for chemical analysis of steels: Part IV Determination of carbon by gravimetric method (for carbon $\ngtr$ 0·1 percent) (*second revision*).

2.5 Activity — The material shall pass the requirements of the test prescribed in Appendix B.

3. PACKING AND MARKING

3.1 Packing — The material shall be packed as agreed to between the purchaser and the supplier.

3.2 Marking — The packages shall be securely closed and legibly and indelibly marked with the following information:

a) Name of the material and its sieve analysis;
b) Manufacturer's name and/or his recognized trade-mark, if any;
c) Mass of the material in the package;
d) Year of packing; and
e) Identification in code or otherwise to enable the batch of manufacture to be traced from records.

3.2.1 The packages may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

4. SAMPLING

4.1 The method of drawing representative samples of the material, number of tests to be performed and the method of finding out the conformity of the material to the requirements of the specification shall be as prescribed in Appendix C.

APPENDIX A

(*Clause* 2.4)

METHODS OF TEST FOR IRON POWDER (REDUCTION GRADE)

A-1. QUALITY OF REAGENTS

A-1.1 Unless specified otherwise, pure chemicals and distilled water (*see* IS : 1070-1960*) shall be employed in tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

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*Specification for water, distilled quality (*revised*).

A-2. DETERMINATION OF VOLATILE MATTER

A-2.1 Procedure — Weigh accurately about 25 g of the material in a flat dish. Spread it out as evenly as possible and dry for 24 hours in vacuum over concentrated sulphuric acid.

A-2.2 Calculation

$$\text{Volatile matter, percent by mass} = \frac{100 \times (M_1 - M_2)}{M_1}$$

where

M_1 = mass in g of material taken for the test, and
M_2 = mass in g of the material after drying.

A-3. DETERMINATION OF ELEMENTAL IRON

A-3.1 Reagents

A-3.1.1 *Mercuric Chloride* — solid.

A-3.1.2 *Dilute Sulphuric Acid* — approximately 10 percent (*v/v*).

A-3.1.3 *Standard Potassium Permanganate Solution* — 0·1 N.

A-3.2 Procedure — Weigh accurately about 1 g of the material in a conical flask. Add 5·0 g of mercuric chloride and 50 ml of water. Boil for 5 minutes with frequent agitation. Cool, transfer quantitatively to a 100-ml volumetric flask, dilute to 100-ml mark with freshly boiled and cooled water, mix and filter. Immediately take 20 ml aliquot of the solution, add 10 ml of dilute sulphuric acid and titrate the ferrous iron with standard potassium permanganate solution.

A-3.2.1 Dissolution of iron and cooling of the solution shall be carried out in an atmosphere of carbon dioxide.

A-3.3 Calculation

$$\text{Elemental iron (Fe), percent by mass} = \frac{27{\cdot}92\, VN}{M}$$

where

V = volume in ml of the standard potassium permanganate solution used in the titration,
N = normality of the potassium permanganate solution, and
M = mass in g of the material taken for the test.

A-4. TEST FOR MANGANESE

A-4.1 Apparatus

A-4.1.1 *Nessler Cylinders* — 50 ml capacity.

A-4.2 Reagents

A-4.2.1 *Concentrated Nitric Acid* — *See* IS : 264-1968*.

A-4.2.2 *Concentrated Sulphuric Acid* — *See* IS : 266-1961†.

A-4.2.3 *Silver Nitrate Solution* — approximately 0·1 N.

A-4.2.4 *Ammonium Persulphate* — solid.

A-4.2.5 *Standard Potassium Permanganate Solution* — Dilute 9·1 ml of 0·1 N potassium permanganate solution with water to 100 ml. The solution should always be prepared fresh before use. One millilitre of this diluted solution corresponds to 0·1 milligram of manganese (as Mn).

A-4.3 Procedure — Digest 1·0 g of the material with 5 to 8 ml of concentrated nitric acid previously diluted to 50 ml with water. When all the powder has dissolved, filter the contents in a 250-ml measuring flask. Wash the filter paper with water and collect the washings in the flask. Make the volume to the mark. Shake well. Pipette 10 ml of the solution in a 250-ml beaker, add 10 ml of concentrated sulphuric acid and boil the contents till all the fumes of nitrates as well as chlorides are removed and sulphur trioxide fumes start coming. Cool, add 25 ml of water, 15 ml of silver nitrate solution and 1 g of ammonium persulphate. Boil to develop the permanganate colour (indicating the presence of manganese) and then continue boiling for 30 seconds after oxidation starts and bubbles of oxygen appear from decomposition of the persulphate. Cool the contents and make the volume to 50 ml in a Nessler cylinder.

A-4.3.1 Carry out a control test using 2 ml of standard potassium permanganate solution diluted to 10 ml with water, proceeding in exactly the same way as with the material under test.

A-4.4 The material shall be taken to have satisfied the requirements of the test if the colour produced, if any, in the test with the material is not deeper than that produced in the control test.

A-5. DETERMINATION OF SULPHUR

A-5.1 Reagents

A-5.1.1 *Concentrated Nitric Acid* — *See* IS : 264-1968*.

---

*Specification for nitric acid (*first revision*).

†Specification for sulphuric acid (*revised*).

A-5.1.2 *Concentrated Hydrochloric Acid — See* IS : 265-1962*.

A-5.1.3 *Dilute Hydrochloric Acid* — 10 percent (*v/v*).

A-5.1.4 *Bromine Solution* — 5 percent in water containing 5 percent potassium bromide.

A-5.1.5 *Aluminium Metal* — strips.

A-5.1.6 *Ammonium Hydroxide* — 18 N approximately.

A-5.1.7 *Barium Chloride Solution* — approximately 10 percent (*m/v*).

A-5.2 Procedure

A-5.2.1 Weigh about 5 g of the material accurately in a porcelain dish. Add 10 ml of concentrated nitric acid and 5 ml of bromine solution. Stir the material and solution frequently. After 4 hours, heat the mixture to dryness on water-bath. Add a few drops of concentrated hydrochloric acid to moisten and evaporate to dryness again. Add 10 ml of concentrated hydrochloric acid and 10 ml of water. Dissolve iron by heating. Filter, if necessary. Wash the filter paper alternately with dilute hydrochloric acid and hot water, till all iron is removed. (Six washings should be adequate.) Collect the filtrate and washings in a 500-ml beaker. Add a few pieces of aluminium metal strip and reduce iron to ferrous condition by heating. Add ammonium hydroxide drop by drop till a permanent precipitate persists. Add 2 ml of excess concentrated hydrochloric acid. (Volume should be 200 ml approximately at this stage.) Add 10 ml of barium chloride solution and heat just to boil. Remove from source of heat and keep overnight. Filter through filter paper (Whatman No. 42 or equivalent). Wash the filter paper with dilute hydrochloric acid and hot water alternately till free from iron. Continue washing with hot water till free from chloride. Ignite the filter paper and the precipitate, cool and weigh to constant mass. Run a blank simultaneously.

A-5.2.2 *Alternate Procedure* — Pass iron solution before reduction with aluminium through a column of cation exchange resin. Collect the filtrate in a 500-ml beaker. Wash the column thrice with 25 ml of water every time. Collect the filtrates, reduce the volume by boiling to about 250 ml. Neutralize with ammonium hydroxide using methyl orange as indicator. Add one millilitre of concentrated hydrochloric acid in excess. Heat to boil. Add 10 ml of barium chloride solution in a thin stream while the solution is boiling. Continue boiling till precipitate settles. Keep overnight. Filter through filter paper (Whatman No. 42 or equivalent). Wash with hot water till free from chlorides. Ignite filter paper and precipitate in a porcelain crucible to about 800°C to constant mass. Cool and weigh. Run a blank simultaneously.

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*Specification for hydrochloric acid (*revised*).

A-5.3 Calculation

$$\text{Sulphur (as S), percent by mass} = \frac{13{\cdot}74\,(M_1 - B)}{M}$$

where

M_1 = mass in g of barium sulphate precipitate obtained,

B = mass in g of the precipitate obtained in the blank experiment, and

M = mass in g of the material taken for the test.

A-6. DETERMINATION OF PHOSPHORUS

A-6.1 Reagents

A-6.1.1 *Concentrated Nitric Acid* — *See* IS : 264-1968*.

A-6.1.2 *Ammonium Hydroxide* — 18 N approximately.

A-6.1.3 *Ammonium Molybdate Solution* — Dissolve 55 g of ammonium molybdate and 50 g of ammonium nitrate in 18 ml of ammonium hydroxide and 20 ml of water, and stir. Dilute to about 700 ml with water and heat for half an hour with occasional stirring until solution is complete. Dilute the solution to one litre. Let the solution stand overnight and filter (without washing the residue).

A-6.1.4 *Potassium Nitrate Solution* — approximately one percent (*m/v*).

A-6.1.5 *Dilute Sodium Hydroxide Solution* — approximately 0·1 N.

A-6.1.6 *Standard Hydrochloric Acid* — 0·1 N.

A-6.1.7 *Phenolphthalein Indicator Solution* — Dissolve 0·1 g of phenolphthalein in 100 ml of 60 percent rectified spirit.

A-6.2 Procedure — Dissolve about 5 g of the material, accurately weighed, in 20 ml of water and 20 ml of concentrated nitric acid. Evaporate on a steam-bath to a syrupy liquid. Add 50 ml of water and filter. To the filtrate and washings, add 15 ml of concentrated nitric acid and 13 ml of ammonium hydroxide and then an excess of ammonium molybdate solution. Keep it warm at about 40°C for 5 minutes with frequent shaking. Then allow to stand for one hour.

A-6.2.1 If a yellow precipitate is formed, filter and wash with potassium nitrate solution until filtrate is neutral to litmus paper. Transfer the filter paper containing the precipitate into a flask, add 25 ml of water and 50 ml of sodium hydroxide solution. Agitate the flask until the precipitate has completely dissolved. Add 2 to 3 drops of phenolphthalein indicator and titrate the excess alkali with standard hydrochloric acid.

---

*Specification for nitric acid (*first revision*).

A-6.2.2 Carry out a control titration using exactly 50 ml of dilute sodium hydroxide solution.

A-6.3 Calculation

$$\text{Phosphorus (P), percent by mass} = \frac{0{\cdot}1349\,(V_1 - V_2)\,N}{M}$$

where

V_1 = volume in ml of standard hydrochloric acid required for titrating 50 ml of dilute sodium hydroxide solution in the control titration,

V_2 = volume in ml of standard hydrochloric acid required for titrating excess alkali in the test with the material,

N = normality of standard hydrochloric acid, and

M = mass in g of the material taken for the test.

A-7. DETERMINATION OF SILICON

A-7.1 Reagents

A-7.1.1 *Dilute Nitric Acid* — approximately 6 N.

A-7.1.2 *Perchloric Acid* — 60 to 70 percent.

A-7.1.3 *Dilute Hydrochloric Acid* — approximately 5 N.

A-7.1.4 *Dilute Sulphuric Acid* — approximately 18 N.

A-7.1.5 *Hydrofluoric Acid*

A-7.2 Procedure — Treat about 2 g of the material, accurately weighed, with 40 ml of dilute nitric acid in a 400-ml beaker covered with a watch-glass. When the reaction is complete, rinse and remove the watch-glass cover and add 40 ml of perchloric acid. Evaporate till fumes of perchloric acid are evolved. Replace the cover on the beaker and heat for 15 minutes so that the perchloric acid condenses and runs down the sides of the beaker. Do not allow the contents of the flask to become pasty or solid. Cool a little and dilute with 125 ml of hot water. Stir until all salts have dissolved, crushing all lumps with a glass rod. Filter and transfer the residue to an ashless filter paper with the aid of dilute hydrochloric acid and repeat this treatment to ensure complete removal of silica. Wash alternately with 5-ml portions of hot dilute hydrochloric acid and hot water until all iron salts have been removed. Carry out the washing carefully since residual perchloric acid may cause loss of material in subsequent ignition of the precipitate.

Transfer the paper containing the residue to a weighed platinum crucible and ignite strongly until all the carbon is burnt off. Cool in a desiccator and record the mass. Moisten the residue with sulphuric acid and add about 5 ml of hydrofluoric acid. Heat inside an air-bath until all sulphuric acid is expelled and then heat strongly. Cool and weigh. The difference in the last two weighings represents the mass of silica (SiO_2).

A-7.3 Calculation

$$\text{Silicon (as Si), percent by mass} = \frac{46.75 \times M_1}{M}$$

where

M_1 = mass in g of the silica (SiO_2) as found in **A-7.2**, and
M = mass in g of the material taken for the test.

APPENDIX B

(*Clause* 2.5)

DETERMINATION OF ACTIVITY

B-1. APPARATUS

B-1.1 The apparatus shall be assembled as shown in Fig. 1.

B-2. REAGENTS

B-2.1 Concentrated Hydrochloric Acid — *See* IS : 265-1962*.

B-3. PROCEDURE

B-3.1 Weigh 2 g of the material and add it to a 500-ml 3-necked flask. Add 50 ml of water. In the dropping funnel, take 50 ml of concentrated hydrochloric acid. See that the set-up is leak-proof. Drop the acid into the 500-ml flask, note immediately the time and collect the water displaced by evolved gas into the measuring cylinder, keeping level of the levelling tube always the same as in 2-litre flask (originally containing 1·5 litres of water). Note the volume of water displaced at intervals of 2 minutes. Carry out the experiment for 60 minutes. The temperature of water during the test shall not exceed the room temperature.

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*Specification for hydrochloric acid (*revised*).

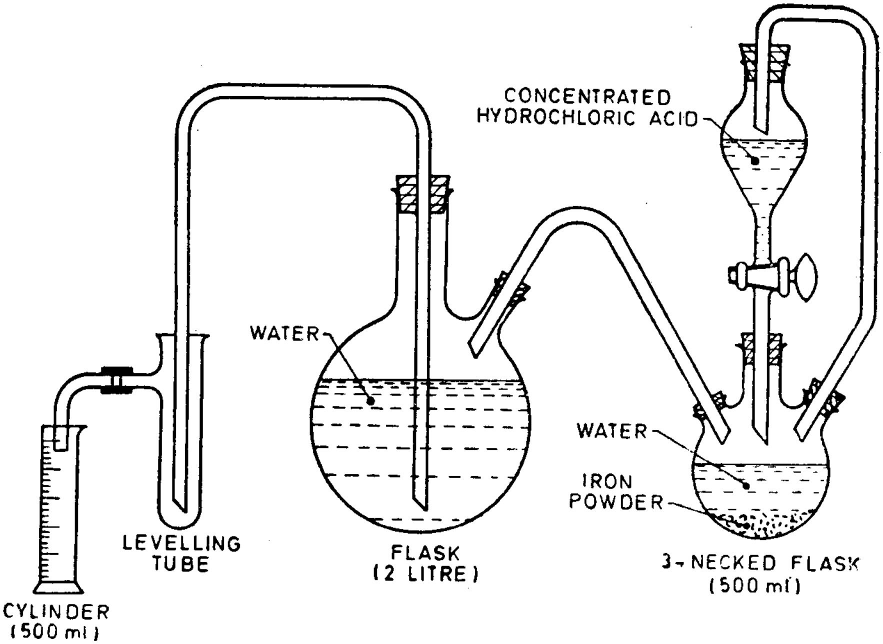

FIG. 1 ASSEMBLY OF APPARATUS FOR THE DETERMINATION OF ACTIVITY

B-3.2 The rate of evolution of hydrogen by iron powder shall be as given below:

Time	*Hydrogen Gas Evolved*	*Time*	*Hydrogen Gas Evolved*
(1)	(2)	(1)	(2)
min	ml	min	ml
2	100	20	500
4	175	25	550
6	245	30	590
8	300	35	615
10	350	40	640
12	385	45	650
14	420	50	675
16	445	55	685
18	475	60	695

APPENDIX C

(*Clause* 5.1)

SAMPLING OF IRON POWDER (REDUCTION GRADE)

C-1. GENERAL REQUIREMENTS OF SAMPLING

C-1.0 In drawing, preparing, storing and handling samples, the following precautions and directions shall be observed.

C-1.1 Samples shall not be taken in an exposed place.

C-1.2 The sampling instrument shall be clean and dry when used.

C-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contamination, particularly from absorption of water.

C-1.4 To draw a representative sample, the contents of each container selected for sampling shall be mixed as thoroughly as possible by suitable means.

C-1.5 The samples shall be placed in suitable, clean, dry and air-tight glass or any other containers on which the material has no action.

C-1.6 The sample containers shall be of such a size that they are almost completely filled by the sample.

C-1.7 Each sample container shall be sealed air-tight with a suitable stopper after filling, and marked with full particulars of the material (*see* **3.2**) and the date of sampling.

C-1.8 Samples shall be stored in a cool and dry place.

C-2. SCALE OF SAMPLING

C-2.1 Lot—All the containers in a single consignment of the material drawn from the single batch of manufacture shall constitute a lot. If a consignment is declared to consist of different batches of manufacture, the batches shall be marked separately and the groups of containers in each batch shall constitute separate lots.

C-2.1.1 Samples shall be tested for each lot separately for ascertaining conformity of the lot to the requirements of this specification.

C-2.2 The number of containers (n) to be selected from the lot shall depend on the size of the lot (N) and shall be in accordance with col 1 and 2 of Table 2.

TABLE 2 NUMBER OF CONTAINERS TO BE SELECTED FOR SAMPLING

(*Clause* C-2.2)

LOT SIZE N (1)	NUMBER OF CONTAINERS TO BE SELECTED n (2)
Up to 50	3
51 to 150	4
151 ,, 300	5
301 ,, 500	6
501 and above	7

C-2.3 These containers shall be selected at random from the lot. In order to ensure the randomness of selection, random sampling procedures given in IS:4905-1968* may be followed.

C-3. PREPARATION OF TEST SAMPLES AND REFEREE SAMPLES

C-3.1 From each of the containers selected according to **C-2.3**, draw with a suitable sampling instrument representative portion of material sufficient for carrying out triplicate determination of each of the characteristics.

C-3.2 Out of these portions collected from all the selected containers, equal quantity of material shall be taken and mixed thoroughly to form composite sample. The composite sample so formed shall be divided into three equal parts, one for the purchaser, another for the supplier and the third to be used as referee sample.

C-3.3 The remaining portion of the material from each container shall be divided into three equal parts and each such part shall constitute an individual sample. One set of individual samples shall be marked for the purchaser, another for the supplier and the third one for the referee.

C-3.4 All the individual and composite samples shall be immediately transferred to separate containers and labelled with full identification particulars.

C-3.5 The referee sample consisting of a composite sample and set of (n) individual samples shall bear the seal of both the purchaser and the supplier This shall be kept at a place agreed to between the purchaser and the supplier to be used in case of a dispute between the two.

---

*Methods for random sampling.

C-4. NUMBER OF TESTS

C-4.1 Tests for determination of volatile matter and elemental iron content shall be carried out on each of the individual samples.

C-4.2 Tests for remaining characteristics given in Table 1, carbon (**2.3**) and activity (**2.5**) shall be performed on the composite sample only.

C-5. CRITERIA FOR CONFORMITY

C-5.1 For Individual Samples — For those characteristics which are tested on individual samples (*see* **C-4.1**), the mean and range of test results shall be computed as follows:

$$\text{Mean } (\bar{X}) = \frac{\text{Sum of the individual test results}}{\text{Number of tests}}$$

Range (R) = Difference between the maximum and the minimum values of test results.

C-5.1.1 For declaring the conformity of the lot to the specification requirement of volatile matter, $\bar{X} + 0{\cdot}6\ R$, computed from test results, shall be less than or equal to 0·25. The relevant conformity criterion for elemental iron is that $\bar{X} - 0{\cdot}6\ R$ computed from test results shall be greater than or equal to 93·0.

C-5.2 For Composite Sample — For declaring the conformity of the lot to the specification requirements of all the characteristics tested on the composite sample (*see* **C-4.2**), the value of each of the test results shall be as specified for the corresponding characteristic.

C-5.3 A lot shall be declared as conforming to the requirements of this specification if the conditions given in **C-5.1** and **C-5.2** are satisfied.

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Central :	Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002	331 01 31 331 13 75
*Eastern :	1/14 C. I. T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054	36 24 99
Northern :	SCO 445-446, Sector 35-C, CHANDIGARH 160036	2 18 43 3 16 41
Southern :	C. I. T. Campus, MADRAS 600113	41 24 42 41 25 19 41 29 16
†Western :	Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093	6 32 92 95

Branch Offices:	
'Pushpak', Nurmohamed Shaikh Marg, Khanpur, AHMADABAD 380001	2 63 48 2 63 49
‡Peenya Industrial Area 1st Stage, Bangalore Tumkur Road BANGALORE 560058	38 49 55 38 49 56
Gangotri Complex, 5th Floor, Bhadbhada Road, T. T. Nagar, BHOPAL 462003	6 67 16
Plot No. 82/83, Lewis Road, BHUBANESHWAR 751002	5 36 27
53/5, Ward No. 29, R.G. Barua Road, 5th Byelane, GUWAHATI 781003	3 31 77
5-8-56C L. N. Gupta Marg (Nampally Station Road), HYDERABAD 500001	23 10 83
R14 Yudhister Marg, C Scheme, JAIPUR 302005	6 34 71 6 98 32
117/418 B Sarvodaya Nagar, KANPUR 208005	21 68 76 21 82 92
Patliputra Industrial Estate, PATNA 800013	6 23 05
T.C. No. 14/1421, University P.O., Palayam TRIVANDRUM 695035	6 21 04 6 21 17

Inspection Offices (With Sale Point):	
Pushpanjali, First Floor, 205-A West High Court Road, Shankar Nagar Square, NAGPUR 440010	2 51 71
Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005	5 24 35

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*Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep Street, Calcutta 700072 — 27 68 00

†Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400007 — 89 65 28

‡Sales Office in Bangalore is at Unity Building, Narasimharaja Square, Bangalore 560002 — 22 36 71

Reprography Unit, BIS, New Delhi, India